

## **Title: Down on the Farm**

### **Brief Overview:**

Given real-life information regarding farm life, students will design their own farm, select crops and animals, make a cost/profit analysis and data analysis, and communicate these ideas to their classmates/groups.

### **NCTM 2000 Principles for School Mathematics:**

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

### **Links to NCTM 2000 Standards:**

#### **• Content Standards**

##### **Number and Operations**

Students will demonstrate their ability to convert from United States customary to metric units when planning their farm. They will use a budget/expense sheet to determine which animals/crops they will choose for their farm. Students will apply proportional conversions to create a scale drawing of their farm.

##### **Geometry**

Students will design their farm from a given space. They will maximize the area, given a perimeter, and accurately draw the related spaces.

##### **Measurement**

Students will convert between length and area measurements. They will convert between the various measurement systems.

##### **Data Analysis and Probability**

Students will utilize given data and represent data in an appropriate graphical representation. They will interpret the results of this graph.

- **Process Standards**

**Mathematics as Problem Solving, Reasoning and Proof, Communication, Connections, and Representation**

These five process standards are threads that integrate throughout the unit, although they may not be specifically addressed in the unit. They emphasize the need to help students develop the processes that are the major means for doing mathematics, thinking about mathematics, understanding mathematics, and communicating mathematics.

**Grade/Level**

Grades 6-8

**Duration/Length:**

This unit will take approximately five or six 45-minute mathematics periods.

**Prerequisite Knowledge:**

Students should have working knowledge of the following:

- Calculating area and perimeter
- Adding and multiplying decimals
- Drawing and interpreting line and bar graphs
- Converting from one unit to another

**Student Outcomes:**

Students will:

- apply proportions and formulas to design a scale farm model.
- apply percents to find loss of profits.
- use graphs to analyze data and make decisions based on variety of influencing factors.
- use technology to search the Internet for information.
- use technology to create spreadsheets and to write.
- use communication skills to give an oral presentation to persuade based on reasoning and logic.

**Materials/Resources/Printed Materials:**

- Calculators
- Pencils/ Paper
- Rulers
- Worksheets (included)
- Cardstock, glue, markers, tape - etc. to build model of farm (optional)

**Development/Procedures:**

- **Day 1/Day 2**

Students will work in groups of 3 or 4. Each group inherits a plot of land measuring 300 yards by 242 yards. The Farmers' Bureau has agreed to consider making a loan. Students must provide an adequate plan and show how the farm would be run.

Students will:

- calculate the area of the farm in acres and hectares;
- compute the perimeter of the farm and compute the cost of fencing;  
(**Worksheet 1A** and **Information Sheet 1**)
- select the kinds of crops/animals or any combination thereof;
- name and design the physical layout of the farm to scale;  
(**Worksheets 1A, 1B, and 1C**)
- choose and build storage facility for crops and/or feed; and
- complete the expense sheet for the farm  
(Agro-Business Budget-**Worksheet 2** and **Information Sheet 1**)

The instructor will define the following terms with the students:

- acre
- hectare
- cost
- profit
- expense
- loss
- revenue
- gross
- capital

This process should take up to two **forty-five minute** class periods.

**Homework Sheet 1** - Students will list the expenses a farm might incur.

- **Day 3**

Budgeting/Revenue

Students will predict their farm's revenue using the Revenue Sheet (**Worksheet 3 and Information Sheet 2**) they will receive by looking up their costs. The projected revenue must be reasonable and students should be able to justify their costs. They will complete their projection by using the Expenses and Profits sheets.

- **Day 4**

Students will plot the costs and revenues of the crops and animals on their farm using the appropriate graph. They will label the axes, choose an appropriate scale, and name their graph. (**Graph Sheet-Worksheet 4**) Students will write a brief paragraph explaining why they chose the animals and crops using the information deemed from their expense and revenue sheets to support their decisions. (**Homework Sheet 2**)

- **Day 5**

Each group will be randomly assigned one Natural Disaster. These disasters are included on **Information Sheet 3**. The groups will receive an **Information Sheet 4**, labeled "Natural Disasters." Each member of the group should read the information about Natural Disasters. First, they must see if they lost any money for the year after the natural disaster. Then, they must apply problem solving skills to salvage the farm after the Natural Disaster.

• **Day 6**

Each group will make a presentation showing the plan for their farm and an accurate estimate for the loan request to the Farmers' Bureau. You should use materials that will enhance your presentation. Your logic should support your reasoning.  
Examples: dioramas, charts, graphs, etc.

**Performance Assessment:**

To assess this unit, use any or all of the following - based on teacher preference:

- Included Rubrics for each of the worksheets
- Oral presentation rubric for overall assessment

**Extension/Follow Up:**

- Students can use the Internet to explore farms in other countries and substitute the appropriate crops and animals for that country.
- Students can explore the volume vs. surface area of various three-dimensional shapes to determine the most cost-effective storage facility.
- Students can enter data into a graphing calculator or spreadsheet to further their technological expertise.
- Students could visit a working farm to see their research put to use in real-life.
- Students will apply their knowledge of costs and revenue to future decision making situations.

**References:**

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- "Could Mad Cow Disease Happen Here?" Shell, Ellen Ruppel. Atlantic Monthly, p. 92, Sept. 1998.
- "Drought Won't Go Away" Anwar, Yasmin. USA Today, p. 1, March 14, 2000.
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- "Don't be Down on the Farm" Dorgan, Byron. Washington Monthly, p 9-13, Jan/Feb 2000.

**Authors:**

Michelle Johncock  
Maret School  
Washington, DC

April Rearick  
E. Russell Hicks  
Washington County, MD

Minnie Dyer  
John Philip Sousa Middle School  
Washington, DC

Samuel Kamara  
Garnet-Patterson Middle School  
Washington, DC

# Down on the Farm

**Names:** \_\_\_\_\_

Your old Uncle MacDonald has died bequeathing to you a plot of land measuring 242 yards by 300 yards. The provision of your inheritance is that you must build a working farm on the land. The Farmers Bureau has agreed to consider making a loan to you to help you build your farm. You will need to provide the loan officers with an adequate plan and show them how you would run your farm. All week you will be working on activities to help you develop a feasible plan for your farm and an accurate estimate for your loan request.

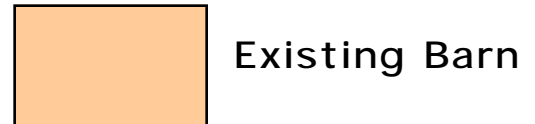
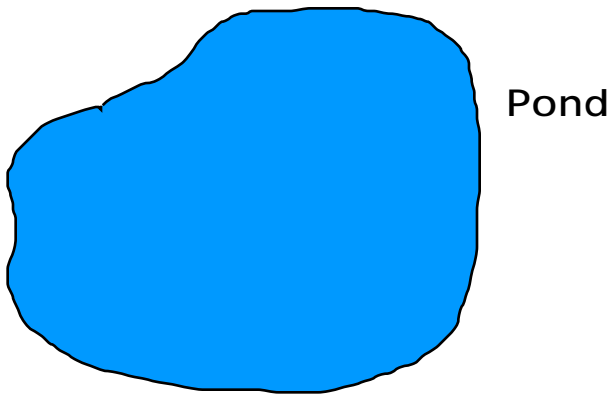
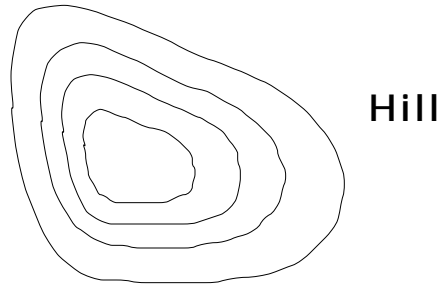
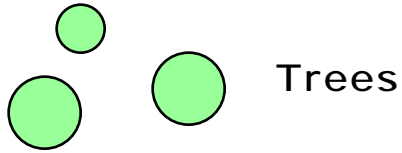
- First you'll need to calculate the area of your farm in both hectares and acres. One acre = 4840 yds<sup>2</sup> and one acre = 0.405 hectares
- Compute the perimeter of your farm, and calculate the cost of fencing in your farm. (*Do you need to fence in the entire farm?*) (See Information Sheet 1.)
- Choose the types of animals and/or crops you wish to have on your farm. *Don't forget that for each animal you choose you need to build a habitat. Habitat sizes are on the next page.*
- Choose the number of silos for your crops. Each type of crop needs its own storage facility.
- Once you've chosen the animals and/or crops for your farm you are ready to design the physical layout of your farm on the provided land plot. *Keep in mind the topographical features of the land, and make sure you maintain your drawing to scale!*

# Down on the Farm

## Areas of Housing for Each Animal

Pigs	8 ft <sup>2</sup> / pig or sow, at least 50 pigs, if any
Chickens	1sq. ft. of floor space per bird, at least 500 chickens, if any
Cows	4 cows/ acre
Rabbits	5 sq. ft./ rabbit, at least 100 rabbits

# Key to Farm Map



Keep in mind while drawing on the map sheet that  
1 inch = 30 yards. Do your best to draw your objects  
to scale.

# Down on the Farm

Name \_\_\_\_\_

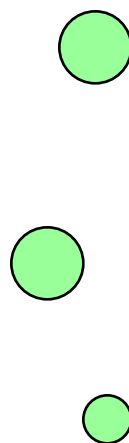
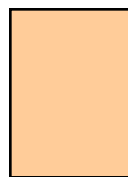
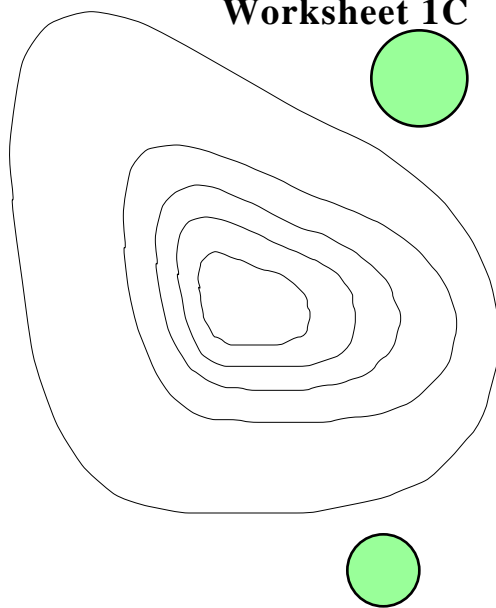
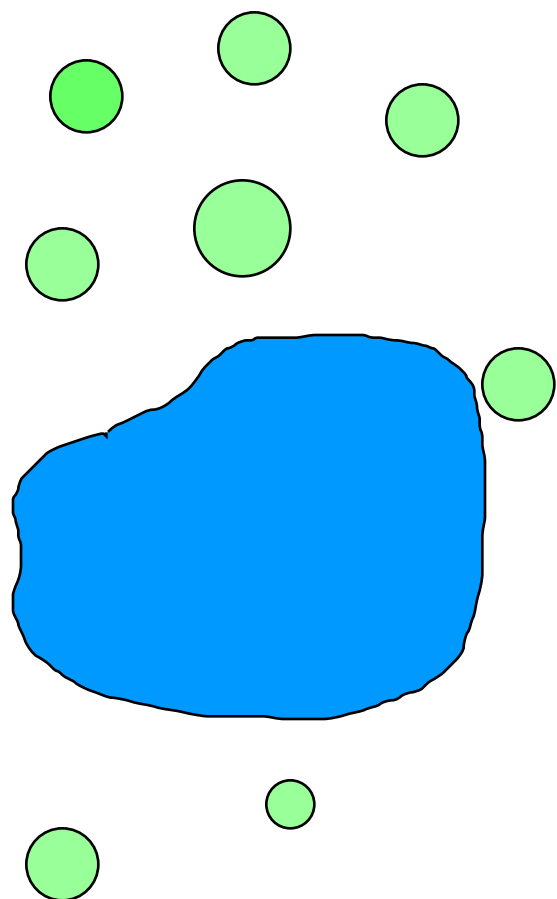
So now you have a farm! Unfortunately, farms don't run themselves and you need to start thinking about the related expenses. List any expenses that a farmer might incur. Separate them into costs for crops and costs for animals.

Crop Costs

Animal Costs

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**Worksheet 1C**



# Down on the Farm

## Expenses for your farm:

- **Equipment:**

Tractors	\$10,000 each
Combines	\$18,000 each
Maintenance	\$13.50 per acre
Silos	\$30,000 each
Fencing	\$30 per yard

- **Seeds**

Corn	\$18 per acre
Soybeans	\$20 per acre
Wheat	\$16 per acre

- **Animals**

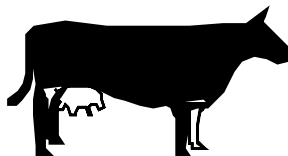
Piglets	\$ 80 per pig
Care	\$900 per pig
Day Old Chicks	\$100 per dozen
Care	\$300 per chicken
Cows	\$ 450 per calf
Care	\$1000 per calf per year
Rabbits	\$ 50 per rabbit
Care	\$200 per rabbit per year

- **Other**

Fertilizers	\$ 5.25 per acre per year
Pesticides	\$25.00 per acre per year
Electricity	\$13.50 per acre per year
Water	\$10.75 per acre per year
Gas	\$15.75 per acre per year

## AGRO-BUSINESS BUDGET

### COSTS/INPUT



#### 1. FIXED CAPITAL

ITEM	QTY	COST(ea)	TOTAL	5 YR
TRACTOR		\$	\$	\$
SILOS		\$	\$	\$
FENCING		\$	\$	\$
MACHINERY (OTHERS)		\$	\$	\$
TOTAL		\$	\$	\$

#### 2. VARIABLE CAPITAL

ITEM	QTY	COST(ea)	TOTAL	5 YR
CORN SEEDS		\$	\$	\$
SOYBEAN SEEDS		\$	\$	\$
WHEAT SEEDS		\$	\$	\$
FERTILIZERS		\$	\$	\$
PESTICIDES		\$	\$	\$
ELECTRICITY		\$	\$	\$
WATER		\$	\$	\$
GAS		\$	\$	\$
PIGLETS		\$	\$	\$
DAY OLD CHICKS		\$	\$	\$
CALVES		\$	\$	\$
RABBITS		\$	\$	\$
TOTAL		\$	\$	\$

#### 3. GRAND TOTAL

ITEM		TOTAL	TOTAL	TOTAL
FIXED CAPITAL		\$	\$	\$
VARIABLE CAPITAL		\$	\$	\$
GROSS		\$	\$	\$

# Down on the Farm

## Profits (in a year)

### Crops

	Number of Bushels per acre	Cost per Bushel
Wheat	35	\$4.15
Soybeans	25	\$6.95
Corn	85	\$2.95

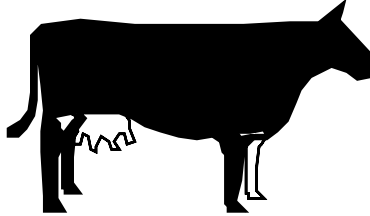
### Animals

Chickens	300 eggs per year	\$0.75 per dozen
Cows	100 lbs. of milk per year	\$0.45 per lb.
Rabbits	50 rabbits	\$30 per rabbit
Pigs	250 lbs. per year	\$0.75 per lb.



## REVENUE SHEET

### REVENUE/RECEIPTS



### CROPS REVENUE

ITEM	Revenue for 5 Years
CORN	\$
SOYBEANS	\$
WHEAT	\$
TOTAL	\$

### LIVESTOCK REVENUE

ITEM	Revenue for 5 Years
EGGS	\$
MILK	\$
PIGS	\$
RABBITS	\$
TOTAL	\$

### TOTAL RECEIPTS

ITEM	TOTAL RECEIPTS for 5 Years
CROPS	\$
LIVESTOCK	\$
GROSS REVENUE	\$

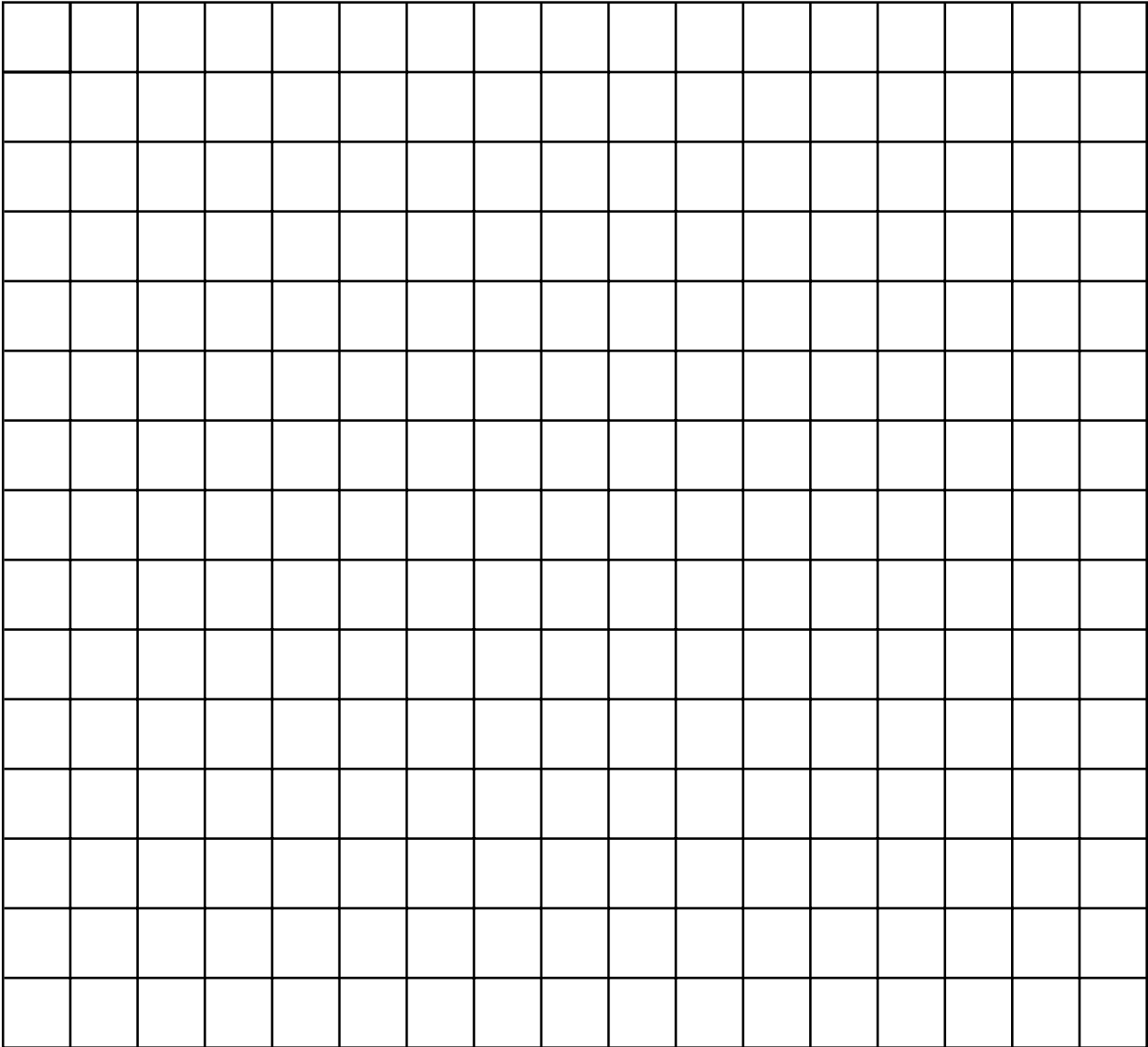
### PROFIT

PROFIT = TOTAL RECEIPTS (TOTAL REVENUE) - TOTAL COSTS

# Down on the Farm

Name \_\_\_\_\_

Plot the costs and revenues of the crops and animals on your farm using the appropriate graph. Label the axes, choose an appropriate scale and name your graph.



[illegible]

# Scenarios

*Teachers should separate each of the following scenarios and let groups choose them randomly.*

## **Scenario 1**

A drought has hit this summer. Your farm loses 30% of its crops and because of lack of food, it also loses 25% of its animals.

## **Scenario 2**

Disease has come to your farm. Fifty percent of your cows have “mad cow” disease and cannot be sold nor produce milk. Twenty-five percent of your pigs were lost to disease ridden feed, also.

## **Scenario 3**

Your farm was flooded. You lost 40% of your crops and 20% of your animals stock.

## **Scenario 4**

Your corn was infected with the Corn Flea Beetle, and you lost 80% of your corn crop. Due to lack of food for the animals, 15% of your animals had to be sold immediately.

# Down on the Farm

## Natural Disasters

No matter what, farmers are going to have some difficulties during their career as a farmer. Most do not give up, however. Whether it is drought, disease, flooding or pests, the farmers find a way to face their difficulty and survive their dilemma.

### Drought

Drought is not a rare event, it actually happens everywhere. The definition of a drought is a prolonged lack of precipitation (rain), usually meaning a season or more. When farming, drought participates in less good crops for farmers to sell, therefore causing them to earn less. Vegetables are usually smaller and do not taste as good as when there is enough rain. Sometimes the Government will help out the farmers by either giving them money or giving them loans, but a lot of times it is not sufficient to help the farmer. You may think that this would not have an effect on you if you have an animal farm, but consider what your animals eat. If you do not have food for your animals, they will be scrawny and not produce as you need them to. Drought will also cause your animals to dehydrate faster, maybe even causing death.

### Disease

Sometimes a farmer may run into the problem of disease in their animals. The biggest problem you have probably heard of was the “mad cow” disease that killed 27 humans and forced 3.7 million cattle into the slaughter house. Just imagine what that could do in America considering the United States raises 10 times the amount of cattle as Europe. This disease, along with other neurological diseases, causes insanity and eventually death. The way it passed from one animal to another is by eating the meat of an infected animal. Many times farmers have some meat from animal in their food to provide protein for their stock. If the meat is infected, the animal eating it most likely will soon be infected also.

Other diseases are passed by flies, mosquitoes, birds, skunks, and rodents. This is why it is important to keep habitats clean. Sick animals should be kept away from the rest of the stock. Habitats need to be well cleaned, if not destroyed, if sick animals have lived there.

### **Flooding**

Many farmers complain about not enough rain, but there is also a problem with too much rain. In 1999 Hurricane Floyd destroyed 2.3 million acres of crops in North Carolina alone. The problem with too much rain is that it drains the nutrients from the soil and carries these nutrients (along with fertilizers and herbicides) to the coast. This rain also pulls the good topsoil from the ground. This leads to a loss of production for that season, and with the lack of nutrients, sometimes the farmers cannot plant the next season's crops, either. If the flood waters stand long enough, and are at the right time, farmers may not get crops planted at all.

### **Pests**

Many times when we think of pests infesting a crop we think of the old cartoons where a swarm of bugs come from the sky eat all the crops planted in the fields and then fly away. However, there is much more to the pest problem than that. For instance, in Zambia, there were pests that manifested themselves in stored crops. These were called Larger Grain Borers, and they destroyed much of the stored grains. What was worse was when these grains were transported, the Larger Grain Borers transferred to storage that now became their new home. These are just tiny bugs, but in numbers, they do a lot of damage.

There is a bug called the Corn Flea Beetle that transmits a disease to the corn. This causes the corn to wilt and reduces the amount of food a farmer can produce. In wheat there is a disease called Scab which is caused by microscopic organisms. These turn the grain yellow and reduce the quality along with the quantity of grain produced. Sometimes the resulting crops can actually be toxic to humans. There are many other diseases that can affect a number of different crops.

Whether it is the climate, critters, or a combination of both, farmers have difficulty with both their crops, and their animals. Your mission is to figure out how you should financially deal with the situation. Good luck!

# Assessment Activities

## Rubric A - Worksheet 1

### Scale Drawing and Farm Planning. (Assessing proportion computation, geometric drawing, and spatial relation skills)

- 4 Points
  - all drawings to scale according to 1 inch = 30 yards.
  - farm map shows all animal habitats, storage facilities, and fencing.
  - neat and tidy.
- 3 Points
  - drawing's scale is off, or some items are not to scale.
  - farm map shows all animal habitats, storage facilities, and fencing.
  - neat and tidy.
- 2 Points
  - drawing's scale is off, or some items are not to scale.
  - farm map shows animal habitats, storage facilities, and fencing, but it is incomplete.
  - neat and tidy.
- 1 Point
  - no attempt to draw items to scale has been made.
  - farm map shows animal habitats, storage facilities, and fencing, but it is incomplete.
  - neat and tidy.

## **Rubric B - Worksheets 3 & 4**

### **Computational Assessment - (Assessing computational abilities related to completing the expense and revenue sheets)**

- 3 Points - All computations are correct based on items chosen on first day.
- 2 Points - 75% of computations are correct.
- 1 Point - 50% of computations are correct.
- 0 Points - less than 50% of computations are correct.

## **Rubric C - Essay/ Worksheet 5**

### **Essay Assessment - (Assessing reasoning and communication skills)**

**Students have written a brief paragraph on the following points:**

- Why did you and your teammates choose the animals and crops that you did?
  - Do your expense and revenue sheets support your decisions? If so, how?
  - If your expense and revenue sheets do not support your decisions, what decisions would you have made differently given the expenses and revenues for each crop and/or animal?
- 
- 3 Points - completely answered above questions.  
- included references to expense and revenue sheets.  
- neatly written/typed in organized paragraph form.
  - 2 Points - partially answered above questions.  
- included references to expense and revenue sheets.  
- neatly written/typed in organized paragraph form.
  - 1 Point - partially answered above questions/ not all questions answered.  
- neatly written/typed in organized paragraph form.

## **Rubric D - Worksheet 6/ Bar Graph Sheet**

**Graphical Assessment - (Assessing ability to choose correct graph format for data, to choose an appropriate scale, and to correctly graph data and interpret the result)**

- 4 Points
  - double bar graph correctly displays expense and revenue data from Worksheets 3 & 4.
  - scale for both axes makes graph accurate and easy to read.
  - graph is labeled with categories on the x-axis and money values on y-axis.
  - the difference between the bars is correctly interpreted as profit/loss.
- 3 Points
  - double bar graph correctly displays expense and revenue data from Worksheets 3 & 4.
  - scale for graph is inaccurate/inappropriate
  - graph is labeled .
  - the difference between the bars is correctly interpreted as profit/loss.
- 2 Points
  - bar graph(s) display(s)s expense and revenue data from Worksheets 3 & 4.
  - scale for graph is inaccurate/inappropriate.
  - graph is labeled.
  - the difference between the bars is correctly interpreted as profit/loss.
- 1 Point
  - the graphing choice is inappropriate but displays the correct data.
  - there is a scale for the graph.
  - the graph is labeled.

## **Rubric E - Natural Disaster**

- 4 Points
  - all mathematical calculations are accurate.
  - solutions are well thought out and feasible.
  - explanations are clear.
- 3 Points
  - few errors in mathematical calculations.
  - solutions are feasible but may not be thought out as well as a 4.
  - explanations may not be as thorough as a 4.
- 2 Points
  - several errors in mathematical calculations.
  - solutions somewhat feasible.
  - weak explanations of solutions.
- 1 Point
  - many errors in mathematics.
  - solutions are not feasible.
  - little or no explanation.

## **Rubric F - Oral Presentation**

**Presentation Assessment - (Assessing ability to communicate to a group using visual references, reasoning, and persuasion based on computations and predictions from the completion of all activities.)**

*Suggestion - Photo copy and pass out a copy of this sheet to each of the groups prior to their presentation so they know on what they will be graded. Then pass out more copies to your students so they may assess one another's presentations. Grade groups based on compilation of your whole class' assessments.*

**Groups are using their data analysis and reasoning abilities to persuade the group of loan officers from the Farmer's Bureau to approve a loan so they may start their farming business. The following points should be addressed in their presentation:**

- Prove using the cost sheet, revenue sheet, and graph that the farm will eventually make a profit. If there is doubt as to the farm's profitability, explain the changes to be made to ensure a profit.
  - Show calculations and data to support the amount of money being requested for the loan.
  - Prove preparation to deal with future acts of nature which may disrupt the farm's operations.
  - Display in either a 2 or 3 dimensional model the plan for the physical lay-out of the farm.
- 
- 4 Points - all of the above points are adequately addressed, the model is presented, and the loan would be approved.
  - 3 Points - all of the above points are addressed, the model is presented, but loan may not be approved due to questionable profitability or poor preparation for acts of nature.
  - 2 Points - 2 of the 3 points are addressed, the model is displayed, but the loan may not be approved due to questionable profitability or poor preparation for acts of nature.
  - 1 Point - above points are not adequately addressed, and loan definitely would not be approved.